

---

## Rule WLM355: Device DISC time was a major cause of DASD I/O delay

---

**Finding:** CPExpert has determined that device DISC time was a major cause of delay in DASD response for the I/O operations of the service class.

This finding applies only to MVS versions prior to OS/390 Release 3, and to MVS versions with OS/390 Release 3 if I/O Priority Management has **not** been specified.

**Impact:** This finding may have a MEDIUM IMPACT or HIGH IMPACT on the performance of the service class.

**Logic flow:** The following rules cause this rule to be invoked:

- Rule WLM350: I/O activity may have caused significant delays
- Rule WLM351: I/O activity may have caused significant delays
- Rule WLM352: I/O activity may have caused significant delays for server service class
- Rule WLM353: I/O activity may have caused significant delays for server service class

**Discussion:** DISC time is the time (1) from when the controller initiates a SEEK Channel Command Word (and the seek requires an arm movement) on the device until the SEEK command is complete, (2) plus the time of the rotational delay while the SET SECTOR Channel Command Word is executing, and (3) plus the rotational position sensing (RPS) delay time required because of missed RPS reconnect. Please see Rule WLM350 for a discussion of DISC time.

CPExpert computes the average per-second DISC delay time as described in Rule WLM350. Rule WLM355 is produced if the average DISC time accounted for a significant percent of the response time of transactions in the service class missing its performance goal.

The following example illustrates the output from Rule WLM355:

---

RULE WLM355: DEVICE DISCONNECT TIME WAS A MAJOR CAUSE OF DASD DELAYS

A major part of the potential I/O delay to the TSO Service Class could be attributed to device disconnect (DISC) time. Disconnect time is caused by seeking or missed rotational position reconnect (RPS). Please refer to the WLM Component User Manual for advice on how to minimize device DISC time.

**Suggestion:** Large DISC time is caused by device seek delay, device rotational delay, or device missed RPS reconnect delay.

- **Seek delay.** The SEEK command is responsible for positioning the arm to the proper cylinder. If no positioning is required (that is, the arm is already at the proper cylinder), the device is not disconnected. Seek operations occur because of accessing patterns with data sets and because of accessing patterns between data sets. Large seek times usually involve the following situations:
  - Multiple data sets being active on the volume. The data sets can be redistributed among different volumes, to eliminate the seeking on the single volume.
  - Multiple users using the same data set on the volume. While only one data set is involved, the user or application accessing patterns may require frequent arm movement. A partitioned data set in which several TSO users reference different members is a common situation.

Depending upon the data set characteristics, duplicate copies of the data set placed on different volumes may solve the seeking problems.

- **Rotational delay.** The SET SECTOR command is responsible for locating the proper sector on the track as the disk rotates. (Actually, the SET SECTOR command locates a sector three sectors preceding the desired sector. This sector is called the *angular sector*.) The device is disconnected during the SET SECTOR command operation.

The rotational delay may be from zero, to the total time required to rotate the disk to the required sector. It is possible that the required sector will be immediately under the head. In this case there is zero rotational delay. On the other hand, the sector could have just passed under the head before the SET SECTOR command was received by the drive. In this case, a full rotation must be accomplished before the required sector is located. On average, one-half of the rotation time will be required to

---

locate the sector. This time is referred to as the **average latency** of the device. For example, IBM-3390 devices rotate every 14.1 milliseconds and the average latency is 7.1 milliseconds<sup>1</sup>.

It is important to realize that the latency is an average based upon many SET SECTOR commands. Any particular SET SECTOR command may have a latency ranging from zero to the maximum rotational delay.

If there are few I/O commands for a particular device in a given measurement interval, it is uncertain what the average latency will be. However, if there are many I/O commands for a particular device in a given measurement interval, the average latency will normally be one-half of the rotational delay.

The average latency may be (and should be) quite small with cached devices. This is because many I/O requests should be satisfied from the cache and have no latency.

If the average DISC per I/O operation is approximately equal to the average latency for the device type, the device would benefit from caching. If the average DISC per I/O operation is much larger than the average latency for the device type, it is unclear whether the device would benefit from caching.

- **Missed RPS reconnect.** The device attempts to reconnect to the path when the angular sector is reached (the angular sector is described above). If the reconnect attempt is successful before the desired sector is reached, then the device connects and the read or write operation can proceed.

A path must be available for the device to reconnect successfully. If the reconnect is not successful before the desired sector is reached, then the device does not connect, and a complete revolution of the track must occur before the angular sector is again reached. This is called a *missed rotational position sensing reconnect (or missed RPS reconnect)* delay.

There is no action which can alleviate the initial rotational positioning delay (aside from changing device characteristics, such as implementing caching or buffering at the device level). Over a large number of I/O operations, this initial delay will be one-half the rotation times.

However, the missed RPS delay is a function of the probability that the path will be busy when the device attempts to reconnect; the busier the

---

<sup>1</sup>These values apply only to Model 1, Model 2, and Model 3. IBM-3390 Model 9 devices rotate every 45.1 milliseconds and the average latency is 22.8 milliseconds.

---

path(s), the more missed RPS delay. (Note that the path busy time is a function of the connect time of other actuators. The path cannot be busy from the device itself when the device attempts to reconnect.).